JG10 Rec'd PCT/PTO 07 MAR 2002

dc-304666°FORM PTO-1390 TRADEMARK OFFICE (REV 11-2000) U.S. DEPARTMENT OF COMMERCE PATENT AND

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. § 371

ATTORNEY'S DOCKET NUMBER: 449122025300

U.S. APPLICATION NO. (If known, see 37 CFR 1.5): 10/070460 Not yet assigned

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE00/03082	September 6, 2000	September 7,1999

TITLE OF INVENTION

LOCATING A FAULTY LINK SECTION IN AN ACTIVE LONG-TERM CONNECTION

APPLICANT(S) FOR DO/EO/US

Dieter GNEITING et al.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☒ The US has been elected by the expiration of 19 months from the priority date (PCT Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☒ is attached hereto (required only if not communicated by the International Bureau).
   b. ☒ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application under PCT Article 19 (35 U.S.C. 371(c)(2)).
   a. ☐ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☐ A FIRST preliminary amendment.
14. ☐ A SECOND or SUBSEQUENT preliminary amendment.
15. ☐ A substitute specification.
16. ☐ A change of power of attorney and/or address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. ☒ Other items: 1) Application Data Sheet; 2) Int'l Search Report; 3) IPER; 4) Return receipt postcard.

CERTIFICATE OF HAND DELIVERY

I hereby certify that this correspondence is being hand filed with the United States Patent and Trademark Office in Washington, D.C. on March 7, 2002.

Melissa Garton

Melissa Garton

dc-305910

10070460 . 12130[illegible]

JC13 Rec'd PCT/PTO 07 MAR 2002

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY DOCKET NO.
Not yet assigned 10/070460	PCT/DE00/03082	449122025300

21. ☒ The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)):

Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO.....$1,040.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO.....$890.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO.....$740.00

International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provision of PCT Article 33(1)-(4) $710.00

International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) $100.00

	CALCULATIONS PTO USE ONLY	
ENTER APPROPRIATE BASIC FEE AMOUNT =	$890.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$0	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	- 20 =		x $18.00	$0	
Independent claims	- 3 =		x $84.00	$0	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ $280.00	$0	

TOTAL OF ABOVE CALCULATIONS =	$890.00	
☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by ½.	$0	
SUBTOTAL =	$890.00	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +	$0	
TOTAL NATIONAL FEE =	$890.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00 per property** +	$0	
TOTAL FEES ENCLOSED =	$890.00	
	Amount to be refunded:	**$**
	charged:	**$**

a. ☒ Please charge my **Deposit Account No. 03-1952** (referencing Docket No. 449122025300) in the amount of $890.00 to cover the above fees. A duplicate copy of this sheet is enclosed.

b. ☒ The Commissioner is hereby authorized to charge any additional fees that may be required, or credit any overpayment to **Deposit Account No. 03-1952** (referencing Docket No. 449122025300).

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Kevin R. Spivak
Morrison & Foerster LLP
2000 Pennsylvania Avenue, N.W.
Washington, D.C. 20006-1888

SIGNATURE

Kevin R. Spivak
Registration No. 43,148

March 7, 2002

dc-305910

PATENT
Docket No. 449122025300

CERTIFICATE OF HAND DELIVERY

I hereby certify that this correspondence is being hand filed with the United States Patent and Trademark Office in Washington, D.C. on July 8, 2002.

N. DeRiggi

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the application of:

Dieter GNEITING et al.

Serial No.: 10/070,460

Filing Date: to be determined

For: LOCATING A FAULTY LINK SECTION IN AN ACTIVE LONG-TERM CONNECTION

Examiner: Not yet assigned

Group Art Unit: Not yet assigned

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examination on the merits, please amend this application as follows:

In the Title:

Please replace the existing title with the following new title:

LOCATING A FAULTY ROUTE SECTION IN AN ACTIVE NAILED-UP CONNECTION

In the Specification:

Please replace the original specification with the enclosed substitute specification. A mark-up copy of the original specification showing changes is also enclosed.

In the Claims:

Please amend the claims as follows:

1. A method for locating a faulty route section in a nailed-up connection having a number of route sections connected to one another by a number of exchanges, comprising:

activating or looping in a test device at a splitting point which is formed by opening the nailed-up connection with a coupling switch inside one of the exchanges; and

remotely controlling progressive activation of mirror devices from a point of the nailed-up connection remote from the splitting point in the direction of the splitting point until the faulty route section of the nailed-up connection has been found, the test device sending a test signal to the mirror device activated and evaluating the mirrored signal for faults, the mirror device sending back incoming signals.

2. The method as claimed in claim 1, wherein the mirror devices are activated in switching networks between two route sections.

3. The method as claimed in claim 1, wherein the test device has two user channels.

4. The method as claimed in claim 1, wherein the test device sends out a predetermined test bit pattern.

5. A system for locating a faulty route section in a nailed-up connection having a number of route sections connected to one another by a number of exchanges, comprising:

a test device which is activated or looped in at a splitting point and is formed by opening the nailed-up connection with a coupling switch inside one of the exchanges; and

a network controller remotely control activation of mirror devices which send back incoming signals, from a point of the nailed-up connection remote from the splitting point in the direction of the test device until the faulty route section of the nailed-up connection has been found, the test device sending a test signal to the mirror device activated and evaluating the mirrored signal for faults.

6. The system as claimed in claim 5, wherein the mirror devices is activated in switching networks between two route sections.

7. The system as claimed in claim 5, wherein the test device has two user channels.

8. The system as claimed in claim 5, wherein the exchanges allocated to the respective route sections have a remote terminal for activating/deactivating the mirror devices of the route sections.

Add the following new claims:

9. The method as claimed in claim 2, wherein the test device has two user channels.

10. The system as claimed in claim 6, wherein the test device has two user channels.

In the Abstract:

Replace the abstract with the attached substitute abstract.

REMARKS

The above amendments to the specification, claims and abstract have been made to place the application in proper U.S. format and to conform with proper grammatical and idiomatic English. None of the amendments herein are made for reasons related to patentability. No new matter has been added.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "**Version with markings to show changes made**".

In the event that the transmittal letter is separated from this document and the Patent Office determines that an extension and/or other relief is required, Applicant petitions for any required relief including extensions of time and authorizes the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to **Deposit Account No. 03-1952** referencing 449122025300.

Dated: July 8, 2002

Respectfully submitted,

By: _____

Kevin R. Spivak
Registration No. 43,148

Morrison & Foerster LLP
2000 Pennsylvania Avenue, N.W.
Washington, D.C. 20006-1888
Telephone: (202) 887-6924
Facsimile: (202) 263-8396

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Claims:

The claims have been amended as follows:

1. A method for locating a faulty route section in a nailed-up connection ~~which is set up with~~ having a number of route sections ~~(2, 3, 4), which are~~ connected to one another by a number of exchanges, ~~exhibiting the following steps~~ comprising:

~~a)~~

activating or looping in a test device ~~(5)~~ at a splitting point ~~(6)~~ which is formed by opening the nailed-up connection with ~~the aid of~~ a coupling switch inside one of the exchanges~~,~~; and

~~b)~~

remotely ~~controlled~~ controlling progressive activation of mirror devices ~~(17), which send back incoming signals unchanged, step-by-step~~ from a point of the nailed-up connection remote from the splitting point ~~(6)~~ in the direction of the splitting point ~~(6)~~ until the faulty route section ~~(2, 3, 4)~~ of the nailed-up connection has been found, the test device ~~(5)~~ sending a test signal to the mirror device ~~(17)~~ activated ~~in each case~~ and evaluating the mirrored signal for ~~its freedom from faults.~~ faults, the mirror device sending back incoming signals.

2. The method as claimed in claim 1, ~~characterized in that~~ wherein the mirror devices ~~(17)~~ are ~~in each case~~ activated in switching networks between two route sections ~~(2, 3, 4)~~.

3. The method as claimed in ~~one of claims 1 or 2, characterized in that~~ claim 1, wherein the test device ~~(5)~~ has two user channels.

4. The method as claimed in ~~one of the preceding claims, characterized in that~~ claim 1, wherein the test device ~~(5)~~ sends out a predetermined test bit pattern.

5. A system for locating a faulty route section in a nailed-up connection ~~which is set up with~~ having a number of route sections ~~(2, 3, 4), which are~~ connected to one another by a number of exchanges, ~~exhibiting:~~ comprising:

~~a)~~

a test device ~~(5)~~ which is activated or looped in at a splitting point ~~(6) which can be~~ and is formed by opening the nailed-up connection with ~~the aid of~~ a coupling switch inside one of the exchanges~~,~~; and

~~b)~~

a network controller ~~(1) for the~~ remotely ~~controlled~~ control activation of mirror devices~~(17),~~ which send back incoming signals, ~~unchanged, step by step~~ from a point of the nailed-up connection remote from the splitting point ~~(6)~~ in the direction of the test device ~~(5)~~ until the faulty route section ~~(2, 3, 4)~~ of the nailed-up connection has been found, the test device ~~(5)~~ sending a test signal to the mirror device activated ~~in each case~~ and evaluating the mirrored signal for ~~its freedom from~~ faults.

6. The system as claimed in claim 5, ~~characterized in that~~ wherein the mirror devices ~~(17) can be~~ is activated ~~in each case~~ in switching networks between two route sections.

7. The system as claimed in ~~one of claims~~ claim 5 ~~or 6, characterized in that~~ wherein the test device ~~(5)~~ has two user channels.

8. The system as claimed in ~~one of the preceding claims, characterized in that~~ claim 5, wherein the exchanges allocated to the respective route sections ~~(2, 3, 4) in each case~~ have a remote terminal for activating/deactivating the mirror devices ~~(17)~~ of the route sections ~~(2, 3, 4)~~.

LOCATING A FAULTY ROUTE SECTION IN AN ACTIVE NAILED-UP CONNECTION

ABSTRACT

To locate a faulty route section of an active nailed-up connection, the nailed-up connection is opened and a test device is activated, or looped in the case of an external test device, at the splitting point. Mirror devices, which send back incoming signals unchanged, are progressively activated step by step from a point of the nailed-up connection remote from the splitting point in the direction of the splitting point until the faulty route section of the nailed-up connection has been found. The test device in each case sends a test signal to the activated mirror device and evaluates the mirrored signal for its freedom from faults.

Substitute specification

LOCATING A FAULTY ROUTE SECTION IN AN ACTIVE NAILED-UP CONNECTION

CLAIM FOR PRIORITY

This application is a national stage of PCT/DE00/03082 filed 6 September 2000 which claims priority to German application 19942690.2 filed 7 September 1999.

TECHNICAL FIELD OF THE INVENTION

The present invention relates to a method and to a system for locating a faulty route section in an active nailed-up connection.

BACKGROUND OF THE INVENTION

A nailed-up connection represents a supplementary service which can be implemented by features of switching nodes of the public network and is offered by its operator. Supplementary services of the public networks were typically introduced due to the thrust in innovation associated with digitization and the associated expansion of services of the controllers of switching nodes and terminals. Supplementary services are, therefore, typically available to subscribers on digital network nodes.

Such a supplementary service is, for example, the nailed-up connection (NUC) which offers a permanent connection between two subscriber lines and between subscriber lines and junction lines.

In contrast to the dial-up connection in which a subscriber sets up, and clears down again, a connection at any time by inputting dialing information relating to different partner subscribers, a nailed-up connection (NUC) - also called semipermanent leased line, fixed line or direct line - is a fixed connection between two subscribers which is provided by the

operator of a network and can be used by the user for transmitting information without restrictions. It is of no importance whether this nailed-up connection is provided once for a particular period, regularly for a particular period or permanently until canceled.

In contrast to the dial-up connection, the characteristic of an NUC is that the subscriber has no choice of a partner subscriber without administratively requesting another connection via his network operator. On the other hand, the network operator guarantees him a corresponding availability of the connection, i.e. in case of a fault, he must restore this connection as quickly as possible.

Historically, nailed-up connections were always set up in an independent network and the connections were originally physically switched and later established via so-called cross connects. The advantage of these separate networks was, above all, the stability and simplicity of their operation since connections were exclusively set up or cleared down by the network operator. In this arrangement, it was always the entire (physical) subscriber access which was used for an NUC even if the information transmission in the network was already digital.

As digitization moved into the subscriber area - generally introduced with the term Integrated Services Digital Network (ISDN) this technique of switching NUCs was no longer possible as there is already a multi-channel digital access in the subscriber area (e.g. basic access with 2 channels, primary rate access with 30 channels and a variable number of channels with the introduction of xDSL technology). Since, as a result, it was required to use the access of the subscriber in parallel both for NUCs and for dial-up connections, NUCs had to jointly use the access of the subscriber to the PSTN (Public Switched Telephone Network). Consequently, these digital NUCs were also

conducted via the digital telecommunication network, i.e. the same resources are now used both for dial-up connections and for NUCs. The only difference is still that dial-up connections are the responsibility of the subscriber whereas NUCs are the responsibility of the network operator.

The same technique is also used for connecting analog subscriber line circuits where an analog/digital conversion is performed at the network interface; in the network, the connection is digital, in principle.

Such an NUC is implemented in that the network routing between the two subscribers involved is established in a network administration center and the NUC is then set up section by section. One route section in each case comprises the route between a subscriber and a junction line or between two junction lines and relates to the area of an exchange. There is no signaling between the exchanges, between exchange and subscriber and also between the subscribers in the sense of out-slot signaling. Signaling between the subscribers can only be transparent (in-slot) by transmitting control information within the channel switched through. The exchange has no access to this information at all.

Faults on an existing connection can either be detected by the network itself because corresponding network components provide an error message, or by the subscriber because his connection transmission is faulty or impaired. Faults detected by the network generally lead to the clearing down of the connections affected by the fault. In the case of an NUC, the exchange usually automatically attempts to find a backup path and to switch the NUC over to this path.

In the case of dial-up connections, in contrast, it is exclusively the task of the user to set up a new connection. This automatically provides a backup path

or, if faulty resources are used during the setting up of the connection, this is usually detected during the setting up by appropriate tests and the operator is warned. If a fault is detected directly by the subscriber without there being an automatic alarm given in the exchange because it is, e.g. a failure in a part of the connection which is not automatically monitored or a transmission section with a high error rate (e.g. noise, echo, crosstalk, ...), the subscriber will take the same action in the case of a dial-up connection, i.e. set up a new connection with generally different routing.

In the case of an NUC, however, this method cannot be generally applied since

(1) only the network operator has access to the setting up and clearing down of the connection, and

(2) the test capabilities are very restricted because of the lack of signaling

(i.e. the user is not able to eliminate this fault per se).

If the user of an NUC finds a fault, he can only inform the network operator of this. The latter, however, also has no capability of directly testing the (active) NUC connection set up since all test devices existing in the public network only test lines which are in the "idle" or "faulty" state, i.e. are not occupied by an established connection. In particular, solidly established NUCs cannot be directly tested at present. According to the prior art, therefore, the operator only has various indirect possibilities for locating and eliminating the fault:

(1) sending out fault-finding personnel to the two terminals of the NUC in order to be able to detect the fault and to eliminate any terminal problems,

(2) modification of the NUC "on speculation", i.e.

deliberate switch-over in two adjacent exchanges,

(3) testing of the resources which are now free to ascertain whether a fault can be found there, or

(4) connecting the two terminals of the NUC to a free port in the exchange and connecting a separate test device there in order to also locate faults in the subscriber area locally.

This method does not only have the disadvantage that it is very time-consuming and costly, the locating and elimination of the fault is also very complex since it requires synchronization of the test personnel present on site with the operating personnel present in the exchanges involved. In general, this method is characterized by the fact that testing is decentralized, i.e. takes place by geographically separated test personnel and operating personnel.

The second disadvantage lies in the fact that, using this method, the fault can be generally only confined to a complete exchange since it always presupposes the connection of two test devices which, for example, are looped in at the main distribution frame of the exchange.

To solve this problem, a method for detecting fault locations in a transmission network is shown in US Patent No. 5,010,544. A multiplicity of bidirectional connections are used for transmitting the data between two terminals. A checking unit is connected to the first end of the first connection and monitors the transmission of the control signal in the first connection L1. A multiplicity of repeaters are used for interconnecting the bidirectional connections. Each repeater contains a first circuit for transmitting the data from the connection Li into the connection Li+1 and a second circuit for transmitting the data

from the connection Li+1 into the connection Li. In addition, each repeater contains a mirror units which responds to a control signal and sends back the data transmitted from the connection Li. The mirror units can also be contained at another location in the transmission network so that a single checking unit can be used for fault finding in the entire network. The checking unit sends control signals predetermined in accordance with a particular protocol for activating or deactivating the mirror devices.

In US Patent No. 4,564,933, a method for checking an optical digital transmission unit is described in which a test signal consisting of a number of bits is sent by a terminal. The bit length of the test signal determines which repeater is addressed in the transmission system and effects a loop-back in this repeater. Changing the mixture of bits changes the amplitude of the direct voltage generated in the repeater. The amplitude of the direct voltage is compared with a reference value.

SUMMARY OF THE INVENTION

The present invention provides a technique for locating a faulty route section in a nailed-up connection which can also be carried out when the nailed-up connection is active.

According to one embodiment of the invention, there is a method for locating a faulty route section of an active nailed-up connection is provided. The active nailed-up connection includes a number of route sections. The nailed-up connection is opened and a test device is activated, or looped in in the case of an external test device, at a splitting point of the nailed-up connection. Mirror devices which send back incoming signals unchanged are activated step by step progressively from a point of the nailed-up connection remote from the splitting point in the direction of the

splitting point until the faulty route section of the nailed-up connection has been found. For this purpose, the test device sends a test signal to the mirror device activated in each case and evaluates the mirrored signal for its freedom from faults.

In one aspect of the invention, the mirror devices can be activated in each case in switching networks between two route sections.

In another aspect of the invention, the test device can have two user channels.

In still another aspect of the invention, the test device can send out a predetermined test bit pattern.

According to another embodiment of the invention, there is a system for locating a faulty route section in an active nailed-up connection is also provided, the nailed-up connection being set up with a number of route sections. A route section can be an area allocated to an exchange. A test device is provided which is activated, or looped in in the case of an external test device, at a splitting point of the nailed-up connection. A network controller activates mirror devices, which send back incoming signals unchanged step by step from a point of the nailed-up connection remote from the splitting point in the direction of the test device until the faulty route section of the nailed-up connection has been found. The test device is programmed for sending out a test signal to the mirror device activated in each case and for evaluating the mirrored signal for its freedom from faults.

In one aspect of the invention, the mirror devices can be activated in each case in (digital) switching networks between two route sections (area of an exchange).

In one aspect of the invention, the test device may have two user channels (for example ISDN Standard).

In still another aspect of the invention, the exchanges allocated to the respective route sections can have in each case a remote terminal for activating/deactivating the mirror devices of the route sections under control of the network controller.

BRIEF DESCRIPTION OF THE DRAWINGS

Further features, characteristics and advantages of the present invention will be apparent in more detail from the subsequent description of an exemplary embodiments and referring to the accompanying figures of the drawings, in which:

Figure 1 shows a diagrammatic representation of a nailed-up connection with a system for fault locating according to the invention.

Figure 2 shows a flowchart of a method for fault locating according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to figure 1, a nailed-up connection (NUC) with a system according to the invention for locating a faulty route section 2, 3, 4 of the activated nailed-up connection will now be described. The nailed-up connection according to figure 1 establishes a connection between a first subscriber line 7 and a second subscriber line 16. In the undisturbed state, a signal can thus be transmitted from the side of the first subscriber line to the second subscriber line 16 or conversely. The entire nailed-up connected includes the subscriber line (TE1, TE2), the network termination (NT1, NT2) and a number of route sections connected by digital switching networks (as part of the exchanges VST1, VST2, ... VSTn).

The exchange 2 exhibits digital line units (DLU), one of the DLUs being connected to the network termination NT1 for the subscriber line TE1 and the other DLU being connected to a network termination, for example for connecting an external test device 5. In the exchange 1, the nailed-up connection can be opened by a crosspoint switch 12 so that the network termination 6 represents a splitting point of the nailed-up connection. The individual route sections of the nailed-up connection are digitally connected to one another by means of switching networks (group switch, GS).

The invention also deals with the method of locating existing faults in route sections which are switched as NUC, the active NUC remaining established.

A digital connection switched through includes the cascading of the physical route sections 2, 3, 4 which are digitally coupled to one another by the switching networks in the course of the connection. Examples of switching networks are a network termination at the ISDN access, access modules, peripheral concentrators and switching networks in the exchange. This identically applies to analog subscribers at a digital exchange since the subsection between subscriber and exchange is operated as analog subsection.

The switching networks generally provide the capability of connecting not only two crosspoints but also of inserting so-called mirrors 17. These mirrors 17 can be inserted and removed by the operator and are used, among other things, for testing one or more physical route sections before setting up a dial-up connection. The mirror function can be provided as a hardware solution or as a software solution. Characteristics of these mirrors 17 include, for example:

- Received digital information is sent back

immediately.

- The mirror is controllable, i.e. insertable and removable again by a control command input locally or remotely.

The idea is to open the NUC at any point within an exchange and to connect the external test device 5 with two user channels at the splitting point (e.g. via the two user channels of an ISDN interface) or to activate a test device in an exchange by an appropriate command.

The exchange in which the NUC is opened can be selected arbitrarily in the course of the NUC.

The NUC now includes two subsections. Firstly, the external test device 5 is used for locating which of the two subsections the fault is located in. For this purpose, a mirror 17 is inserted at a remote point at the subscriber. This mirror 17 can be located either still in the terminal of the subscriber or in the public network area as close as possible to the interface to the subscriber line circuit (e.g. also in the analog/digital converter in the case of an analog subscriber). The test device 5 then sends a test pattern which is reflected at the mirror 17 and received by the test device 5. Assuming that there is a fault in the subsection, the test pattern is not received or received with faults.

After that, a mirror 17 can be inserted at the faulty subsection step by step backward from the subscriber in the network termination NT, in the subscriber line module (SLM) and step by step in the switching networks in the local exchange of the subscriber up to the trunk interface in the direction of the test device 5 and the above procedure of sending out a test signal and of receiving the mirrored test signal can be repeated. As a result, the fault can be accurately located in the

respective route section. This process can be carried out over a number of exchanges.

When a fault has been located, appropriate reconfiguration and elimination measures can be taken. As mentioned, the test can be performed both by means of the external test device 5 and internally within an exchange by means of special system-oriented test equipment.

These network faults can thus be located completely under control of the operator without having to involve the user to provide help. The individual exchanges can be operated via a remote operating terminal via which the individual mirrors 17 can be selectively controlled in the switching networks.

At present, resources can be checked on idle lines since it is assumed that the user of a faulty line has set up another connection by redialing long ago. Resources can, therefore, be tested by selective testing of a route section.

One advantage of the invention lies in the fact that, by testing on an established (active) nailed-up connection between two terminals, i.e. "end to end" with a step-by-step test toward the test device, the reported fault can be isolated precisely to a route section. In particular, this makes it possible to distinguish between faults in the network and faults in the subscriber line circuit.

An advantage especially lies in the remote-controlled opening and interposing of a mirror function within an active NUC to the test unit in order to provide then for a step-by-step selective testing of this NUC by means of these mirrors. The configuration of the test unit, which handles transmitting, receiving and evaluating of the test patterns, is of no importance

here, i.e. it can be an externally connected test device or a test device available internally in the exchange which is then controlled via the same interface as the mirrors. An essential factor is that this test device can be looped into the NUC.

Referring to figure 2, the method for locating a faulty route section will now be explained again.

Firstly, the sequence is started in S1. The test device is activated in S2 or, respectively, looped in at the splitting point in the case of an external test device as shown in figure 1. In S3, mirror devices are then activated as closely as possible to the respective subscriber lines (see reference symbol 17 in figure 1). The test device then sends out a test signal in the form of a predetermined test bit pattern and (S4) detects in S5 if the two mirrored test signals which it receives mirrored back for evaluation are correct. In the case where the two mirrored test signals are correct in this state in which the mirror devices 17, which are as far apart as possible, are activated, the fault is at the subscriber end (S6) and the sequence is ended (S14) since it is assumed that there is no fault in the nailed-up connection itself which can be eliminated by the network management center.

If it is found in S5 that at least one of the mirrored signals is faulty or is not mirrored back at all, a conclusion regarding the faulty route section is drawn from this mirror response of the test signals in S7.

In S8, the next closer mirror is then activated in the faulty subsection and, for this purpose, the currently activated mirror is first deactivated. After that, a test signal is sent out again in S9 and the test device detects in S10 whether the mirrored test signal is correct. Should it be found in S10 that the mirrored test signal is now correct, the fault is located in

S13 in the route section between the two mirrors last activated and the sequence can be ended in S14.

Should S10 show that the mirrored test signal has not been mirrored back correctly, a test is carried out in S11 to determine if the mirror next to the test device is already set. If this test is answered with no, the sequence goes back to S8 so that the currently activated mirror progressively approaches the test device step by step.

If the test in S11 shows that the mirror next to the test device has already been activated, the fault has been detected in the route section which is located between the mirror last activated (which is closest to the test device) and the test device itself and the sequence can be ended in S14.

Description

LOCATING A FAULTY ROUTE SECTION IN AN ACTIVE NAILED-UP CONNECTION

The present invention relates to a method and to a system for locating a faulty route section in an active nailed-up connection.

A nailed-up connection represents a supplementary service which can be implemented by features of switching nodes of the public network and is offered by its operator. Supplementary services of the public networks were essentially only introduced due to the thrust in innovation associated with digitization and the associated expansion of services of the controllers of switching nodes and terminals. Supplementary services are, therefore, essentially only available to subscribers on digital network nodes.

Such a supplementary service is, for example, the nailed-up connection (NUC) which offers a permanent connection between two subscriber lines and between subscriber lines and junction lines.

In contrast to the dial-up connection in which a subscriber sets up, and clears down again, a connection at any time by inputting dialing information relating to different partner subscribers, a nailed-up connection (NUC) - also called semipermanent leased line, fixed line or direct line - is a fixed connection between two subscribers which is provided by the operator of a network and can be used by the user for transmitting information without restrictions. It is of no importance whether this nailed-up connection is provided once for a particular period, regularly for a particular

period or permanently until canceled.

In contrast to the dial-up connection, the characteristic of an NUC is that the subscriber has no choice of a partner subscriber without administratively requesting another connection via his network operator. On the other hand, the network operator guarantees him a corresponding availability of the connection, i.e. in case of a fault, he must restore this connection as quickly as possible.

Historically, nailed-up connections were always set up in an independent network and the connections were originally physically switched and later established via so-called cross connects. The advantage of these separate networks was, above all, the stability and simplicity of their operation since connections were exclusively set up or cleared down by the network operator. In this arrangement, it was always the entire (physical) subscriber access which was used for an NUC even if the information transmission in the network was already digital.

As digitization moved into the subscriber area - generally introduced with the term Integrated Services Digital Network (ISDN) -, however, this technique of switching NUCs was no longer possible as there is already a multi-channel digital access in the subscriber area (e.g. basic access with 2 channels, primary rate access with 30 channels and a variable number of channels with the introduction of xDSL technology). Since, as a result, it was required to use the access of the subscriber in parallel both for NUCs and for dial-up connections, NUCs had to jointly use the access of the subscriber to the PSTN (Public Switched Telephone Network). In consequence, these digital NUCs were also conducted via the digital telecommunication network, i.e. the same resources

are now used both for dial-up connections and for NUCs. The only difference is still that dial-up connections are the responsibility of the subscriber whereas NUCs are the responsibility of the network operator.

The same technique is also used for connecting analog subscriber line circuits where an analog/digital conversion is performed at the network interface; in the network, the connection is digital, in principle.

Such an NUC is implemented in that the network routing between the two subscribers involved is established in a network administration center and the NUC is then set up section by section. One route section in each case comprises the route between a subscriber and a junction line or between two junction lines and relates to the area of an exchange. There is no signaling between the exchanges, between exchange and subscriber and also between the subscribers in the sense of out-slot signaling. Signaling between the subscribers can only be transparent (in-slot) by transmitting control information within the channel switched through; the exchange has no access to this information at all.

Faults on an existing connection can either be detected by the network itself because corresponding network components provide an error message, or by the subscriber because his connection transmission is faulty or impaired. Faults detected by the network generally lead to the clearing down of the connections affected by the fault. In the case of an NUC, the exchange usually automatically attempts to find a backup path and to switch the NUC over to this path.

In the case of dial-up connections, in contrast, it is exclusively the task of the user to set up a new connection. This automatically provides a backup path or, if faulty resources are used during the setting up of the connection, this is usually detected during the setting up by appropriate tests and the operator is warned. If a fault is detected directly by the subscriber without there being an automatic alarm given in the exchange because it is, e.g. a failure in a part of the connection which is not automatically monitored or a transmission section with a high error rate (e.g. noise, echo, crosstalk, ...), the subscriber will take the same action in the case of a dial-up connection, i.e. set up a new connection with generally different routing.

In the case of an NUC, however, this method cannot be generally applied since

(1) only the network operator has access to the setting up and clearing down of the connection

(2) the test capabilities are very restricted because of the lack of signaling

i.e. the user is not able to eliminate this fault per se.

If the user of an NUC finds a fault, he can only inform the network operator of this. The latter, however, also has no capability of directly testing the (active) NUC connection set up since all test devices existing in the public network only test lines which are in the "idle" or "faulty" state, i.e. are not occupied by an established connection. In particular, solidly established NUCs cannot be directly tested at present. According to the prior art, therefore, the operator only has various indirect possibilities for locating and eliminating the fault:

(1) sending out fault-finding personnel to the two terminals of the NUC in order to be able to detect the fault and to eliminate any terminal problems,

(2) modification of the NUC "on speculation", i.e. deliberate switch-over in two adjacent exchanges,

(3) testing of the resources which are now free to ascertain whether a fault can be found there, or

(4) connecting the two terminals of the NUC to a free port in the exchange and connecting a separate test device there in order to also locate faults in the subscriber area locally.

This method does not only have the disadvantage that it is very time-consuming and costly, the locating and elimination of the fault is also very complex since it requires synchronization of the test personnel present on site with the operating personnel present in the exchanges involved. In general, this method is characterized by the fact that testing is decentralized, i.e. takes place by geographically separated test personnel and operating personnel.

The second disadvantage lies in the fact that, using this method, the fault can be generally only confined to a complete exchange since it always presupposes the connection of two test devices which, for example, are looped in at the main distribution frame of the exchange.

To solve this problem, a method for detecting fault locations in a transmission network is shown in US 5,010,544. A multiplicity of bidirectional connections are used for transmitting the data between

two terminals. A checking unit is connected to the first end of the first connection and monitors the transmission of the control signal in the first connection L1. A multiplicity of repeaters are used for interconnecting the bidirectional connections. Each repeater contains a first circuit for transmitting the data from the connection Li into the connection Li+1 and a second circuit for transmitting the data from the connection Li+1 into the connection Li. In addition, each repeater contains a mirror units which responds to a control signal and sends back the data transmitted from the connection Li. The mirror units can also be contained at another location in the transmission network so that a single checking unit can be used for fault finding in the entire network. The checking unit sends control signals predetermined in accordance with a particular protocol for activating or deactivating the mirror devices.

In US 4,564,933, a method for checking an optical digital transmission unit is described in which a test signal consisting of a number of bits is sent by a terminal. The bit length of the test signal determines which repeater is addressed in the transmission system and effects a loop-back in this repeater. Changing the mixture of bits changes the amplitude of the direct voltage generated in the repeater. The amplitude of the direct voltage is compared with a reference value.

On the basis of the prior art shown, it is the object of the present invention to provide a technique for locating a faulty route section in a nailed-up connection which can also be carried out when the nailed-up connection is active.

According to the invention, this object is achieved by the features of the independent claims. The dependent

claims develop the central concept of the present invention in a particularly advantageous manner.

According to the invention, therefore, a method for locating a faulty route section of an active nailed-up connection is provided. The active nailed-up connection consists of a number of route sections. The nailed-up connection is opened and a test device is activated, or looped in in the case of an external test device, at a splitting point of the nailed-up connection. Mirror devices which send back incoming signals unchanged are activated step by step progressively from a point of the nailed-up connection remote from the splitting point in the direction of the splitting point until the faulty route section of the nailed-up connection has been found. For this purpose, the test device sends a test signal to the mirror device activated in each case and evaluates the mirrored signal for its freedom from faults.

The mirror devices can be activated in each case in switching networks between two route sections.

The test device can have two user channels.

The test device can send out a predetermined test bit pattern.

According to the invention, a system for locating a faulty route section in an active nailed-up connection is also provided, the nailed-up connection being set up with a number of route sections. A route section can be an area allocated to an exchange. A test device is provided which is activated, or looped in in the case of an external test device, at a splitting point of the nailed-up connection. A network controller activates mirror devices, which send back incoming signals unchanged step by step from a point of the nailed-up connection remote from the splitting point in the

direction of the test device until the faulty route section of the nailed-up connection has been found. The test device is programmed for sending out a test signal to the mirror device activated in each case and for evaluating the mirrored signal for its freedom from faults.

The mirror devices can be activated in each case in (digital) switching networks between two route sections (area of an exchange).

The test device may have two user channels (for example ISDN Standard).

The exchanges allocated to the respective route sections can have in each case a remote terminal for activating/deactivating the mirror devices of the route sections under control of the network controller.

Further features, characteristics and advantages of the present invention will be apparent in more detail from the subsequent description of an exemplary embodiment and referring to the accompanying figures of the drawings, in which:

Figure 1 shows a diagrammatic representation of a nailed-up connection with a system for fault locating according to the invention, and

Figure 2 shows a flowchart of a method for fault locating according to the present invention.

Referring to figure 1, a nailed-up connection (NUC) with a system according to the invention for locating a faulty route section 2, 3, 4 of the activated nailed-up connection will now be described. The nailed-up connection according to figure 1 establishes a connection between a first subscriber line 7 and a second subscriber line 16. In the undisturbed state, a

signal can thus be transmitted from the side of the first subscriber line to the second subscriber line 16 or conversely. The entire nailed-up connected consists of the subscriber line (TE1, TE2), the network termination (NT1, NT2) and a number of route sections connected by digital switching networks (as part of the exchanges VST1, VST2, ... VSTn).

The exchange 2 exhibits digital line units (DLU), one of the DLUs being connected to the network termination NT1 for the subscriber line TE1 and the other DLU being connected to a network termination, for example for connecting an external test device 5. In the exchange 1, the nailed-up connection can be opened by a crosspoint switch 12 so that the network termination 6 represents a splitting point of the nailed-up connection. The individual route sections of the nailed-up connection are digitally connected to one another by means of switching networks (group switch, GS).

The invention deals with the method of locating existing faults in route sections which are switched as NUC, the active NUC remaining established.

A digital connection switched through consists of the cascading of the physical route sections 2, 3, 4 which are digitally coupled to one another by the switching networks in the course of the connection. Examples of switching networks are a network termination at the ISDN access, access modules, peripheral concentrators and switching networks in the exchange. This identically applies to analog subscribers at a digital exchange since in this case only the subsection between subscriber and exchange is operated as analog subsection.

The switching networks generally provide the capability of connecting not only two crosspoints but also of inserting so-called mirrors 17. These mirrors 17 can be inserted and removed by the operator and are used, among other things, for testing one or more physical route sections before setting up a dial-up connection. It is of no importance whether this mirror function is provided as hardware solution or as software solution. Essential characteristics of these mirrors 17 are:

- Received digital information must be sent back immediately.

- The mirror must be controllable, i.e. insertable and removable again by a control command input locally or remotely.

The idea is to open the NUC at any point within an exchange and to connect the external test device 5 with two user channels at the splitting point (e.g. via the two user channels of an ISDN interface) or to activate a test device in an exchange by an appropriate command.

The exchange in which the NUC is opened can be selected arbitrarily in the course of the NUC.

The NUC now consists of two subsections. Firstly, the external test device 5 is used for locating which of the two subsections the fault is located in; for this purpose, a mirror 17 must be inserted in each case at the most remote point at the subscriber. This mirror 17 can be located either still in the terminal of the subscriber or in the public network area as close as possible to the interface to the subscriber line circuit (e.g. also in the analog/digital converter in the case of an analog subscriber). The test device 5 then sends a test pattern which is reflected at the mirror 17 and received by the test device 5. Assuming

that there is a fault in the subsection, the test pattern is not received or received with faults.

After that, a mirror 17 can be inserted at the faulty subsection step by step backward from the subscriber in the network termination NT, in the subscriber line module (SLM) and step by step in all switching networks in the local exchange of the subscriber up to the trunk interface in the direction of the test device 5 and the above procedure of sending out a test signal and of receiving the mirrored test signal can be repeated. As a result, the fault can be accurately located in the respective route section. This process can be carried out over a number of exchanges.

When a fault has been located, appropriate reconfiguration and elimination measures can be taken. As mentioned, the test can be performed both by means of the external test device 5 and internally within an exchange by means of special system-oriented test equipment.

These network faults can thus be located completely under control of the operator without having to involve the user to provide help. It is only necessary to ensure that the individual exchanges can be operated via a remote operating terminal via which the individual mirrors 17 can be selectively controlled in the switching networks.

At present, resources can only be checked on idle lines since it is assumed that the user of a faulty line has set up another connection by redialing long ago. Resources can, therefore, only be tested by selective testing of a route section.

The advantage of the invention lies in the fact that, by testing on an established (active) nailed-up

connection between two terminals, i.e. "end to end" with a step-by-step test toward the test device, the reported fault can be isolated precisely to a route section. In particular, this makes it possible to distinguish between faults in the network and faults in the subscriber line circuit.

The advantage especially lies in the remote-controlled opening and interposing of a mirror function within an active NUC to the test unit in order to provide then for a step-by-step selective testing of this NUC by means of these mirrors. The configuration of the test unit, which handles transmitting, receiving and evaluating of the test patterns, is of no importance here, i.e. it can be an externally connected test device or a test device available internally in the exchange which is then controlled via the same interface as the mirrors. The essential factor is only that this test device can be looped into the NUC.

Referring to figure 2, the method for locating a faulty route section will now be explained again.

Firstly, the sequence is started in step S1. The test device is activated in a step S2 or, respectively, looped in at the splitting point in the case of an external test device as shown in figure 1. In a step S3, mirror devices are then activated as closely as possible to the respective subscriber lines (see reference symbol 17 in figure 1). The test device then sends out a test signal in the form of a predetermined test bit pattern and (step S4) detects in a step S5 if the two mirrored test signals which it receives mirrored back for evaluation are correct. In the case where the two mirrored test signals are correct in this state in which the mirror devices 17, which are as far apart as possible, are activated, the fault must be at the subscriber end (step S6) and the sequence is ended

(S14) since it is assumed that there is no fault in the nailed-up connection itself which can be eliminated by the network management center.

If it is found in step S5 that at least one of the mirrored signals is faulty or is not mirrored back at all, a conclusion regarding the faulty route section is drawn from this mirror response of the test signals in a step S7.

In a step S8, the next closer mirror is then activated in the faulty subsection and, for this purpose, the currently activated mirror is first deactivated. After that, a test signal is sent out again in a step S9 and the test device detects in a step S10 whether the mirrored test signal is correct. Should it be found in this step S10 that the mirrored test signal is now correct, the fault is located in a step S13 in the route section between the two mirrors last activated and the sequence can be ended in step S14.

Should step S10 show that the mirrored test signal has not been mirrored back correctly, a test is carried out in a step S11 to determine if the mirror next to the test device is already set. If this test is answered with no, the sequence goes back to step S8 so that the currently activated mirror progressively approaches the test device step by step.

If the test in step S11 shows that the mirror next to the test device has already been activated, the fault has been detected in the route section which is located between the mirror last activated (which is closest to the test device) and the test device itself and the sequence can be ended in step S14.

Patent Claims

1. A method for locating a faulty route section in a nailed-up connection which is set up with a number of route sections (2, 3, 4), which are connected to one another by a number of exchanges, exhibiting the following steps:
a) activating or looping in a test device (5) at a splitting point (6) which is formed by opening the nailed-up connection with the aid of a coupling switch inside one of the exchanges, and
b) remotely controlled progressive activation of mirror devices (17), which send back incoming signals unchanged, step-by-step from a point of the nailed-up connection remote from the splitting point (6) in the direction of the splitting point (6) until the faulty route section (2, 3, 4) of the nailed-up connection has been found, the test device (5) sending a test signal to the mirror device (17) activated in each case and evaluating the mirrored signal for its freedom from faults.

2. The method as claimed in claim 1, characterized in that the mirror devices (17) are in each case activated in switching networks between two route sections (2, 3, 4).

3. The method as claimed in one of claims 1 or 2, characterized in that the test device (5) has two user channels.

4. The method as claimed in one of the preceding claims, characterized in that the test device (5) sends out a predetermined test bit pattern.

5. A system for locating a faulty route section in a nailed-up connection which is set up with a number of route sections (2, 3, 4), which are connected to one another by a number of exchanges, exhibiting:
a) a test device (5) which is activated or looped in at a splitting point (6) which can be formed by opening the nailed-up connection with the aid of a coupling switch inside one of the exchanges, and
b) a network controller (1) for the remotely controlled activation of mirror devices (17), which send back incoming signals unchanged, step by step from a point of the nailed-up connection remote from the splitting point (6) in the direction of the test device (5) until the faulty route section (2, 3, 4) of the nailed-up connection has been found, the test device (5) sending a test signal to the mirror device activated in each case and evaluating the mirrored signal for its freedom from faults.

6. The system as claimed in claim 5, characterized in that the mirror devices (17) can be activated in each case in switching networks between two route sections.

7. The system as claimed in one of claims 5 or 6, characterized in that the test device (5) has two user channels.

8. The system as claimed in one of the preceding claims, characterized in that the exchanges allocated to the respective route sections (2, 3, 4) in each case have a remote terminal for activating/deactivating the mirror devices (17) of the route sections (2, 3, 4).

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

(43) Internationales Veröffentlichungsdatum
15. März 2001 (15.03.2001)

PCT

(10) Internationale Veröffentlichungsnummer
WO 01/19061 A1

(51) Internationale Patentklassifikation[7]: H04M 3/30, H04Q 1/20

(21) Internationales Aktenzeichen: PCT/DE00/03082

(22) Internationales Anmeldedatum:
6. September 2000 (06.09.2000)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
199 42 690.2 7. September 1999 (07.09.1999) DE

(71) Anmelder *(für alle Bestimmungsstaaten mit Ausnahme von US)*: SIEMENS AKTIENGESELLSCHAFT [DE/DE]; Wittelsbacherplatz 2, 80333 München (DE).

(72) Erfinder; und

(75) Erfinder/Anmelder *(nur für US)*: GNEITING, Dieter [DE/DE]; Gräfelfingerstrasse 70, 81375 München (DE). ZISCHKA, Harald [AT/AT]; Beatrixgasse 4A/7, A-2380 Perchtoldsdorf (AT).

(74) Gemeinsamer Vertreter: SIEMENS AKTIENGESELLSCHAFT; Postfach 22 16 34, 80506 München (DE).

(81) Bestimmungsstaaten *(national)*: CN, US.

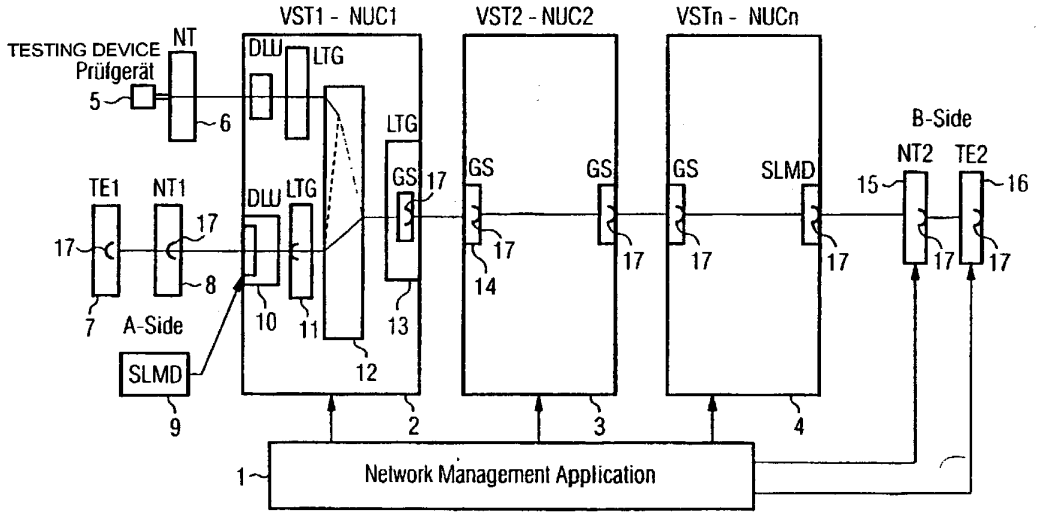
(84) Bestimmungsstaaten *(regional)*: europäisches Patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Veröffentlicht:
— *Mit internationalem Recherchenbericht.*

[Fortsetzung auf der nächsten Seite]

(54) Title: LOCATING A FAULTY LINK SECTION IN AN ACTIVE LONG-TERM CONNECTION

(54) Bezeichnung: LOKALISIERUNG EINES GESTÖRTEN STRECKENABSCHNITTS IN EINER AKTIVEN LANGZEITVERBINDUNG



(57) Abstract: The invention relates to the locating of a faulty link section (2, 3, 4) of an active long-term connection. The long-term connection is interrupted and a testing device (5) is activated at the point of interruption (6), or if the testing device is external, it is connected in. Mirroring devices (17), which send back incoming signals unchanged, are then progressively activated, starting from a point in the long-term connection a distance away from the point of interruption (6) and progressing in the direction of the point of interruption (6), until the faulty link section (2, 3, 4) of the long-term connection has been found. The testing device (5) transmits a test signal to the activated mirroring device (17) respectively and evaluates the mirrored signal for faults.

[Fortsetzung auf der nächsten Seite]

WO 01/19061 A1

1/2

FIG 1

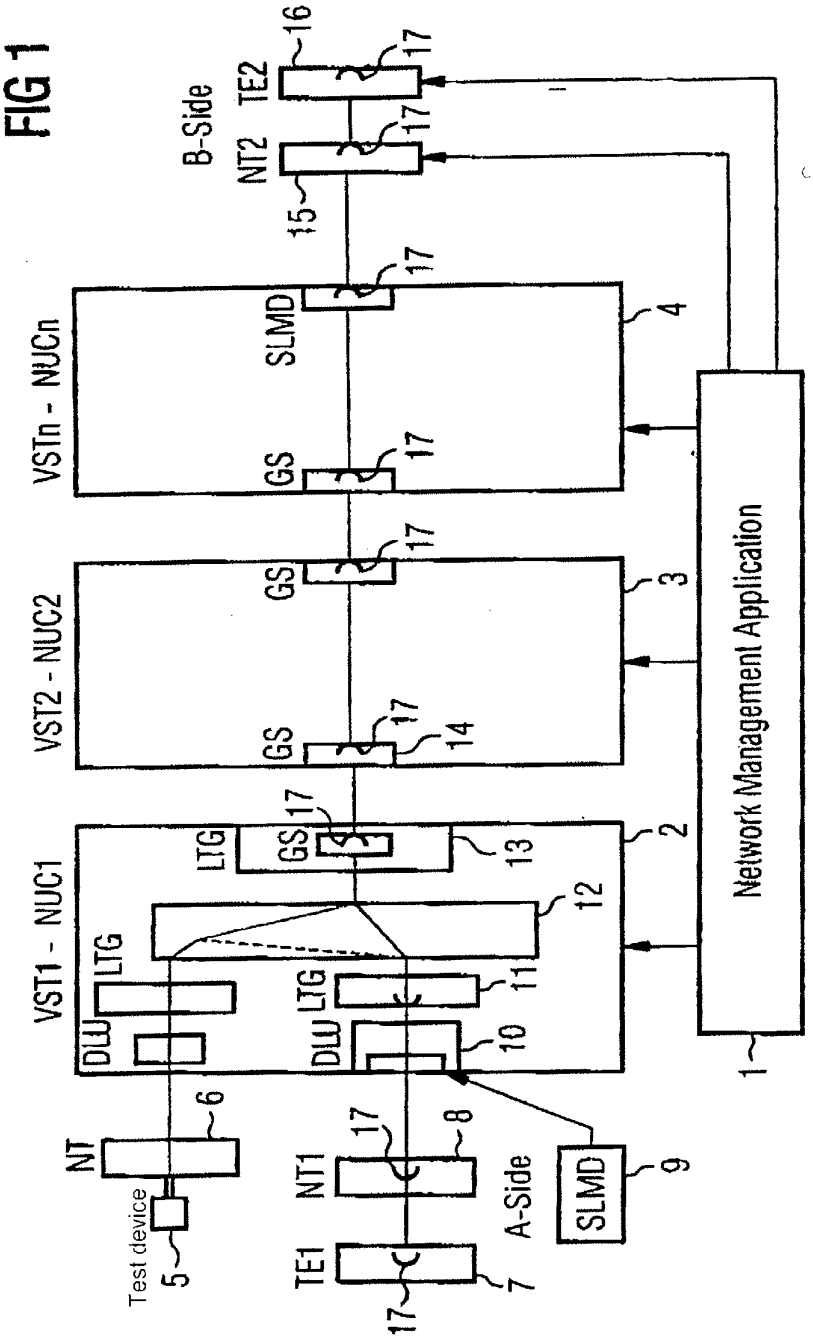
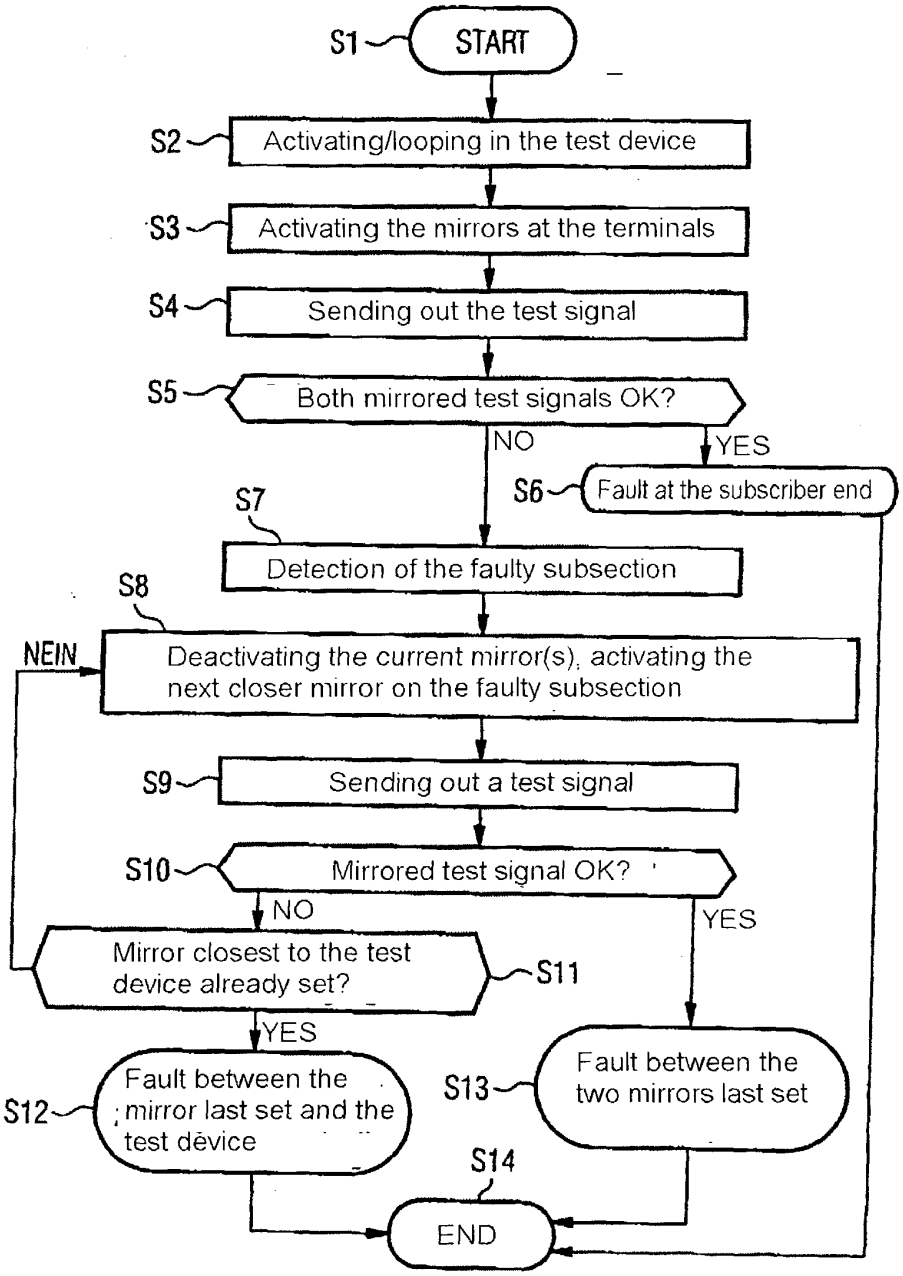

B-Side
TE2
NT2
VSTn - NUCn
SLMD
GS
VST2 - NUC2
VST1 - NUC1
LTG
DLU
NT
NT1
TE1
A-Side
Test device
Network Management Application
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17

FIG 2


S1
START
S2
Activating/looping in the test device
S3
Activating the mirrors at the terminals
S4
Sending out the test signal
S5
Both mirrored test signals OK?
NO
YES
S6
Fault at the subscriber end
S7
Detection of the faulty subsection
S8
NEIN
Deactivating the current mirror(s), activating the next closer mirror on the faulty subsection
S9
Sending out a test signal
S10
Mirrored test signal OK?
NO
YES
Mirror closest to the test device already set?
S11
YES
S12
Fault between the mirror last set and the test device
S13
Fault between the two mirrors last set
S14
END

Declaration and Power of Attorney For Patent Application
Erklärung Für Patentanmeldungen Mit Vollmacht
German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

As a below named inventor, I hereby declare that:

dass mein Wohnsitz, meine Postanschrift, und meine Staatsangehörigkeit den im Nachstehenden nach meinem Namen aufgeführten Angaben entsprechen,

My residence, post office address and citizenship are as stated below next to my name,

dass ich, nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent beantragt wird für die Erfindung mit dem Titel:

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Lokalisierung eines gestörten Streckenabschnitts in einer aktiven Langzeitverbindung

Locating a faulty link section in an active long-term connection

deren Beschreibung

the specification of which

(zutreffendes ankreuzen)
☐ hier beigefügt ist.
☒ am 06.09.2000 als
PCT internationale Anmeldung
PCT Anmeldungsnummer PCT/DE00/03082
eingereicht wurde und am 06.12.2001
abgeändert wurde (falls tatsächlich abgeändert).

(check one)
☐ is attached hereto.
☒ was filed on 06.09.2000 as
PCT international application
PCT Application No. PCT/DE00/03082
and was amended on 06 Dec. 2001
(if applicable)

Ich bestätige hiermit, dass ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe, die eventuell durch einen Zusatzantrag wie oben erwähnt abgeändert wurde.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

Ich erkenne meine Pflicht zur Offenbarung irgendwelcher Informationen, die für die Prüfung der vorliegenden Anmeldung in Einklang mit Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) von Wichtigkeit sind, an.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Abschnitt 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 119 aller unten angegebenen Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde, und habe auch alle Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde nachstehend gekennzeichnet, die ein Anmeldedatum haben, das vor dem Anmeldedatum der Anmeldung liegt, für die Priorität beansprucht wird.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

German Language Declaration

Prior foreign appplications Priorität beansprucht			Priority Claimed	
19942690.2 (Number) (Nummer)	DE (Country) (Land)	07.09.1999 (Day Month Year Filed) (Tag Monat Jahr eingereicht)	☒ Yes Ja	☐ No Nein
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	☐ Yes Ja	☐ No Nein
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	☐ Yes Ja	☐ No Nein

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozeßordnung der Vereinigten Staaten, Paragraph 122 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der früheren Anmeldung und dem nationalen oder PCT internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind.

I hereby claim the benefit under Title 35. United States Code. §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §122, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occured between the filing date of the prior application and the national or PCT international filing date of this application.

PCT/DE00/03082 (Application Serial No.) (Anmeldeseriennummer)	06.09.2000 (Filing Date D, M, Y) (Anmeldedatum T, M, J)	anhängig (Status) (patentiert, anhängig, aufgegeben)	pending (Status) (patented, pending, abandoned)
_____ (Application Serial No.) (Anmeldeseriennummer)	(Filing Date D,M,Y) (Anmeldedatum T, M; J)	_____ (Status) (patentiert, anhängig, aufgeben)	(Status) (patented, pending, abandoned)

Ich erkläre hiermit, dass alle von mir in der vorliegenden Erklärung gemachten Angaben nach meinem besten Wissen und Gewissen der vollen Wahrheit entsprechen, und dass ich diese eidesstattliche Erklärung in Kenntnis dessen abgebe, dass wissentlich und vorsätzlich falsche Angaben gemäss Paragraph 1001, Absatz 18 der Zivilprozessordnung der Vereinigten Staaten von Amerika mit Geldstrafe belegt und/oder Gefängnis bestraft werden koennen, und dass derartig wissentlich und vorsätzlich falsche Angaben die Gültigkeit der vorliegenden Patentanmeldung oder eines darauf erteilten Patentes gefährden können.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

German Language Declaration

VERTRETUNGSVOLLMACHT: Als benannter Erfinder beauftrage ich hiermit den nachstehend benannten Patentanwalt (oder die nachstehend benannten Patentanwälte) und/oder Patent-Agenten mit der Verfolgung der vorliegenden Patentanmeldung sowie mit der Abwicklung aller damit verbundenen Geschäfte vor dem Patent- und Warenzeichenamt: *(Name und Registrationsnummer anführen)*

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

And I hereby appoint

Customer No. 25227

Telefongespräche bitte richten an:
(Name und Telefonnummer)

Direct Telephone Calls to: *(name and telephone number)*

Ext. _____

Postanschrift:

Send Correspondence to:

Morrison and Foerster LLP
2000 Pennsylvania Ave., NW 20006-1888 Washington, DC
Telephone: (001) 202 887 1500 and Facsimile (001) 202 887 0763
or
Customer No. 25227

Voller Name des einzigen oder ursprünglichen Erfinders:	Full name of sole or first inventor:
Dieter Gneiting	Dieter Gneiting
Unterschrift des Erfinders / Datum: 16.4.2002	Inventor's signature / Date: 16.4.2002
Wohnsitz: Muenchen, DEUTSCHLAND	Residence: Muenchen, GERMANY DEX
Staatsangehörigkeit: DE	Citizenship: DE
Postanschrift: Graefelfingerstr 70	Post Office Addess: Graefelfingerstr 70
81375 Muenchen	81375 Muenchen
Voller Name des zweiten Miterfinders (falls zutreffend):	**Full name of second joint inventor, if any:**
HARALD ZISCHKA	HARALD ZISCHKA
Unterschrift des Erfinders / Datum: 26.04.2002	Second Inventor's signature / Date: 26.4.2002
Wohnsitz: 2380 PERCHTOLDSDORF, ÖSTERREICH	Residence: 2380 PERCHTOLDSDORF, AUSTRIA AUX
Staatsangehörigkeit: AT	Citizenship: AT
Postanschrift: BEATRIXGASSE 4A/7	Post Office Address: BEATRIXGASSE 4A/7
A-2380 PERCHTOLDSDORF	A-2380 PERCHTOLDSDORF

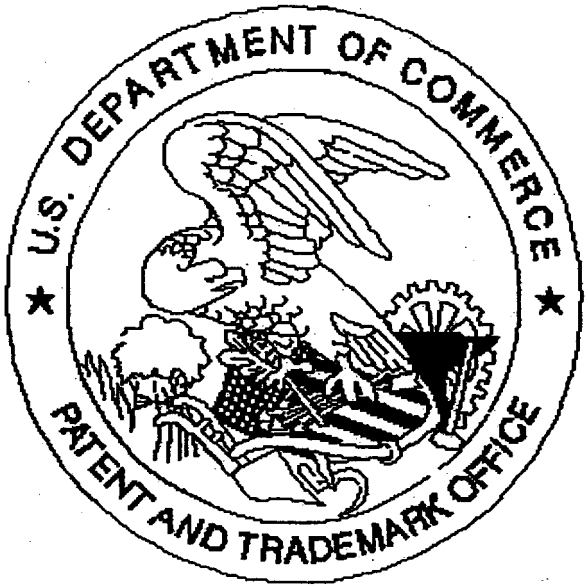
(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

(Supply similar information and signature for third and subsequent joint inventors).

SCANNED, # 24

United States Patent & Trademark Office

Office of Initial Patent Examination -- Scanning Division



Application deficiencies found during scanning:

☒ Page(s)_____ of Application Data Sheet were not present for scanning.
(Document title)

☐ Page(s)_____ of_____ were not present for scanning.
(Document title)

☐ ***Scanned copy is best available.***